

Appendix of Claims

14. A clamping apparatus, comprising:

a driving means (15) provided within a housing (11);

a pull rod (12) having an axis and being reciprocally movable in an axial direction by the driving means (15);

a tapered outer peripheral surface (12a) provided on the pull rod (12), the tapered outer peripheral surface (12a) narrowing toward a first end in the axial direction;

an annular member (13) externally fitted onto the pull rod (12) so as to be movable in the axial direction;

an engaging member (14) provided on a peripheral wall of the annular member (13) and arranged in an outer peripheral space of the tapered outer peripheral surface (12a) so as to be inserted into an engaging hole (2) of an object (1) to be fixed;

an annular gap (31) defined between the housing (11) and an outer peripheral surface of the annular member (13), the annular gap (31) being communicated with a cleaning fluid supply port (40) provided in the housing (11);

and

a support means (29) inhibiting the engaging member (14) from displacing to the first end in the axial direction with a predetermined supporting force and allowing the engaging member (14) to displace to the first end with a force larger than the

supporting force,

wherein the pull rod (12), when driven toward the first end, makes the tapered outer peripheral surface (12a) change over the engaging member (14) to an engaging position (X) far away from the axis so as to engage it with the engaging hole (2) and displacing the engaging member (14) to the first end against the support means (29), thereby adapting a driving force of the pull rod (12) to be transmissible to the object (1) to be fixed,

and on the other hand, when driven toward a second end in the axial direction, the pull rod (12) allows the engaging member (14) to change over to a disengaging position (Y) close to the axis.

15. ² A clamping apparatus, comprising:

a driving means (15) provided within a housing (11);

a pull rod (12) having an axis and being reciprocally movable in an axial direction by the driving means (15), the pull rod (12) being connected to the driving means (15) so as to be radially movable;

a tapered outer peripheral surface (12a) provided on the pull rod (12), the tapered outer peripheral surface (12a) narrowing toward a first end in the axial direction;

an annular member (13) externally fitted onto the pull rod (12) so as to be movable in the axial direction;

an engaging member (14) provided on a peripheral wall of the annular

member (13) and arranged in an outer peripheral space of the tapered outer peripheral surface (12a) so as to be inserted into an engaging hole (2) of an object (1) to be fixed;

an annular gap (31) defined between the housing (11) and an outer peripheral surface of the annular member (13), the annular gap (31) allowing the pull rod (12) and the annular member (13) to move radially with respect to the housing (11); and

a support means (29) inhibiting the engaging member (14) from displacing to the first end in the axial direction with a predetermined supporting force and allowing the engaging member (14) to displace to the first end with a force larger than the supporting force,

wherein the pull rod (12), when driven toward the first end, makes the tapered outer peripheral surface (12a) change over the engaging member (14) to an engaging position (X) far away from the axis so as to engage it with the engaging hole (2) and displacing the engaging member (14) to the first end against the support means (29), thereby adapting a driving force of the pull rod (12) to be transmissible to the object (1) to be fixed,

and on the other hand, when driven toward a second end in the axial direction, the pull rod (12) allows the engaging member (14) to change over to a disengaging position (Y) close to the axis.

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~~16.~~ A clamping apparatus as set forth in claim ~~14~~, wherein the support means (29) comprises a push spring (27) urging the engaging member (14) toward the second end in the axial direction.

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~~17.~~ A clamping apparatus as set forth in claim ~~14~~, wherein the housing (11) is detachably provided with an adapter block (22) for receiving the object (1) to be fixed, the pull rod (12) being inserted into the adapter block (22) movably in the axial direction.

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~~18.~~ A clamping apparatus as set forth in claim ~~17~~, wherein the pull rod (12) is detachably connected to the driving means (15).

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~~19.~~ A clamping apparatus as set forth in claim ~~14~~, wherein the housing (11) includes a lift member (51) arranged to be movable in the axial direction, the lift member (51) being provided with the driving means (15) and the pull rod (12).

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~~20.~~ A clamping apparatus as set forth in claim ~~14~~, wherein the annular member comprises a collet (13), the collet (13) having a peripheral wall which forms the engaging member (14).

2⁸. A clamping apparatus as set forth in claim 2⁷, wherein the support means (29) comprises a push spring (27) urging the engaging member (14) toward the second end in the axial direction.

2⁹. A clamping apparatus as set forth in claim 2⁷, wherein the housing (11) is detachably provided with an adapter block (22) for receiving the object (1) to be fixed, the pull rod (12) being inserted into the adapter block (22) so as to be movable in the axial direction.

2¹⁰. A clamping apparatus as set forth in claim 2⁹, wherein the pull rod (12) is detachably connected to the driving means (15).

2¹¹. A clamping apparatus as set forth in claim 2⁷, wherein the housing (11) includes a lift member (51) arranged to be movable in the axial direction, the lift member (51) being provided with the driving means (15) and the pull rod (12).

2¹². A clamping apparatus as set forth in claim 1², wherein the support means (29) comprises a push spring (27) urging the engaging member (14) toward the second end in the axial direction.

2¹³. A clamping apparatus as set forth in claim 1², wherein the housing (11) is detachably provided with an adapter block (22) for receiving the object (1) to

be fixed, the pull rod (12) being inserted into the adapter block (22) so as to be movable in the axial direction.

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27. A clamping apparatus as set forth in claim ¹³26, wherein the pull rod (12) is detachably connected to the driving means (15).

¹⁵
28. A clamping apparatus as set forth in claim ²14, wherein the housing (11) includes a lift member (51) arranged to be movable in the axial direction, the lift member (51) being provided with the driving means (15) and the pull rod (12).

¹⁴
29. A clamping apparatus as set forth in claim ²15, wherein the annular member comprises a collet (13), the collet (13) having a peripheral wall which forms the engaging member (14).

¹⁷
30. A clamping apparatus as set forth in claim ¹⁴29, wherein the support means (29) comprises a push spring (27) urging the engaging member (14) toward the second end in the axial direction.

¹⁸
31. A clamping apparatus as set forth in claim ¹⁶30, wherein the housing (11) is detachably provided with an adapter block (22) for receiving the object (1) to be fixed, the pull rod (12) being inserted into the adapter block (22) so as to be movable in the axial direction.

¹⁹
~~32~~ A clamping apparatus as set forth in claim ¹⁸~~31~~, wherein the pull rod (12) is detachably connected to the driving means (15).

²⁰
~~33~~ A clamping apparatus as set forth in claim ¹⁴~~28~~, wherein the housing (11) includes a lift member (51) arranged to be movable in the axial direction, the lift member (51) being provided with the driving means (15) and the pull rod (12).
